VOLUME 37, NO. 1 • THE GEORGE WASHINGTON UNIVERSITY • EDITION 2, WINTER 90

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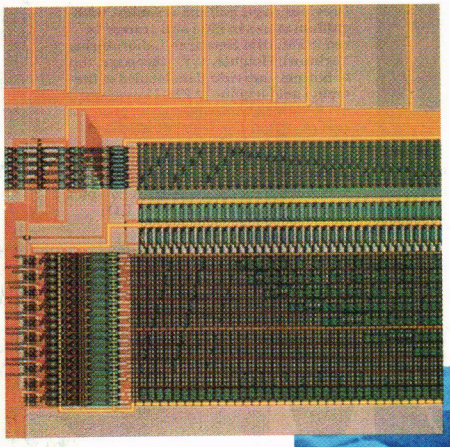
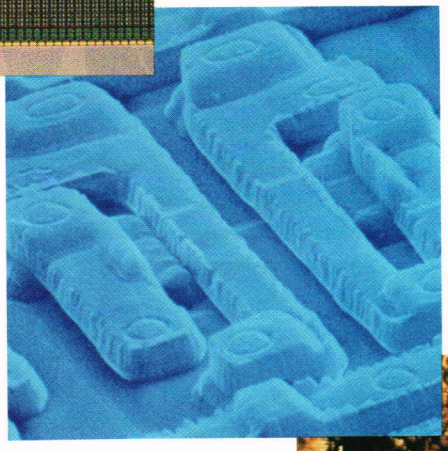
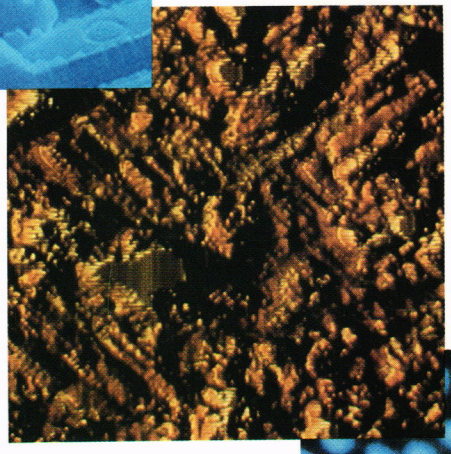


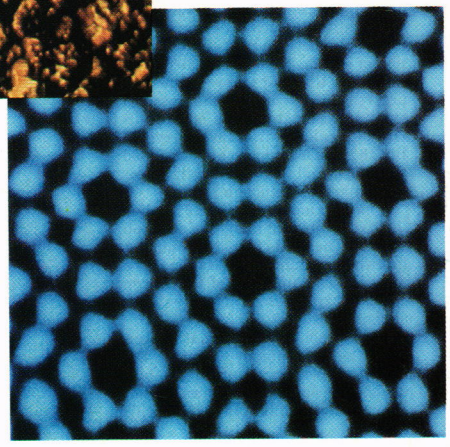
NANOTECHNOLOGY
REVOLUTIONIZING YOUR FUTURE





ENGINEERS' WEEK

TAKING GW BY STORM



PLUS: ALUMNI INTERVIEWS AND MUCH, MUCH, MORE!

VOLUME 37, NO. 1 • THE GEORGE WASHINGTON UNIVERSITY• EDITION 2, WINTER 90

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Established 1942

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THANK YOU

We would like to thank all those who helped us to bring *MECHELECIV* to you this year. A special thanks goes out to our dedicated staff, supportive Engineers' Council, and faithful Engineering Alumni Association. We look forward to serving you again next year. Have a great summer.

NELSON M. KEE

Nelson M. Kee

GLEN L. POPICK

Glen L Popick

COVER Diving into the Nanoworld.

Thes four panels, when viewed from upper-left to lower-right, show a progression of increased magnification. The first panel is at 5 X by a conventional microscope, then an electron microscope in number two can show 300,000 X. The third and fourth panels, made by a scanning tunneling microscope, show molecular and atomic features. Panel three is a contour map of molecules at 3,000,000 X, and panel four shows individual atoms, at 24,000,000 X magnification.

MECHELECIV is a student and alumni magazine published 4 times a year (two times a semester) at the George Washington University by the direction of the Engineers' Council and in cooperation with the Engineer Alumni Association.
MECHELECIV serves the Engineering School community as a responsible student/alumni magazine, independent of the School and University administration in its management and decision making.
MECHELECIV is managed and administered in accordance with the "Policy and Procedures Governing the Cooperative Publication of MECHELECIV by Engineers' Council and Engineer Alumni Association." This document was agreed upon and signed on September 20, 1984 by the Engineers' Council and the Engineer Alumni Association.
Subscription: $10.00 per year. Circulation: 5,000-10,000. ISSN #: 0047-6387. Second class postage paid at Washington, D.C.
Address all communications to: MECHELECIV, Davis-Hodgkins House, 2142 G Street, N.W., Washington, D.C. 20037 or call (202) 994-3998.
The content of this magazine represents the individual expressions of the authors or editors and does not necessarily reflect the views or attitudes of the student body or the University administration.

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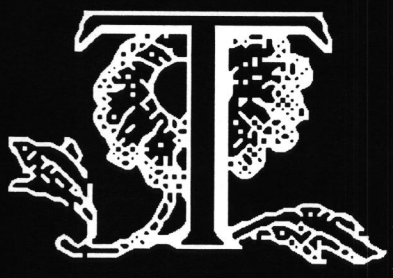
NANOTECHNOLOGY

REVOLUTIONIZING OUR FUTURE!



he articles presented in the following pages were complied by the honors research class of Fall 1989, under the direction of Dr. Douglas Jones. The material for these articles are primarily from the book Engines of Creation: The Coming Era of Nanotechnology, by K. Eric Drexler, and supplemented by various current magazine articles about nanotechnology. These articles represent a partial summary of our studies.

Edited by Glen Popick

Researchers at MIT working on the scanning tunneling microscope. Using the STM these researchers can isolate individual atoms.

NANOTECHNOLOGY

MARCHING US INTO THE 21st CENTURY!

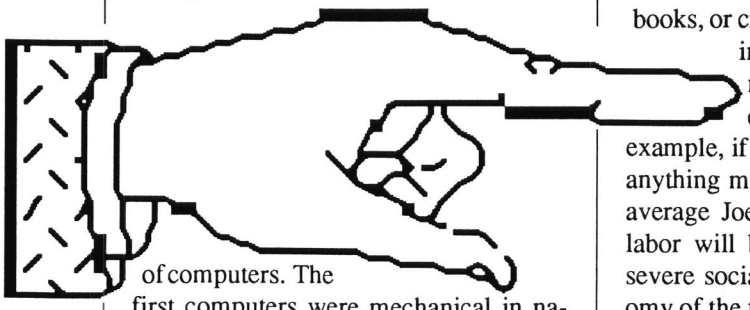
Most of the readers of this magazine have enough background in science, especially chemistry, to appreciate the way that the basic building blocks of nature, namely atoms, are used to create everything from people, to plants to high-performance automobile engines. Until today, man has only dealt with the macroscopic world and has left nature alone to combine atoms into their specific patterns. A new field of technology is emerging that could take nature out of the chain of creation, letting mankind control the basic building processes from the ground up. This amazing new field is called nanotechnology because it deals with processes on the nanometer scale.

The theories behind nanotechnology are based on the natural processes of protein machines, such as viruses and other single-celled organisms. These machines produce DNA, ribosomes, and reproduce on the atomic level. By using nanotechnology to reproduce these processes, scientists could produce not only proteins and DNA, but literally anything, as long as the necessary atoms were present. Since these processes work on the atomic scale, the atoms necessary are abundant.

The most exciting prospect of nanotechnology is the nanomachine, a mechanical device consisting of only several atoms per side, capable of arranging other atoms into any pattern. A nanomachine designed to bond atoms together in a specific pattern is called an assembler. Since assemblers can place atoms in nearly any configuration, any structure can be built that does not violate the basic laws of nature. More advanced assemblers would have the capability to reproduce themselves as well as build a particular substance, thus requiring only a single copy of an assembler to complete a large scale construction.

A similar nanomachine, the disassembler, would allow scientists to dissect single cells, break atomic bonds, and remove atoms, so that raw materials could be released. Also, they could be used to target a harmful cell structure and destroy it, thereby preventing further harm.

Another major facet of nanotechnology will be in the area of computers. The first computers were mechanical in nature, not like todays electrical devices. Pioneers like Charles Babbage, who in the mid-1800's built a computer entirely of brass gears, were defeated by the size, slow speed and cost of these devices. Nanotechnology would solve Babbage's problems, and nano-sized mechanical computers with immense storage capability for their size would rival the speed and efficiency of today's fastest computers. Although mechanical signals move orders of magnitude slower than their electrical counterparts, the mechanical signal would only have to travel a few nanometers, thereby raising the speed immensely.



Although in the past new developments have taken decades to be realized on the general populace, once fully-functioning assemblers are built, it may be only a matter of months before their impact on society is significant or even dangerous. The dream of today's experimenters would be to create a so called "gray goo," containing millions of nanomachines. Just mix in the necessary raw materials, and *voila*: a perfectly ripe apple, a new chair, or even a new house. This process would not happen instantaneously, but it would be self perpetuating. These ideas present a rapid change for society, not all of which is good. The nanomachines could be used to create abominations that only appear in horror books, or create hordes of new weapons inexpensively. The effects of nanotechnology on society could also more subtle. For example, if nanomachines are able to do anything more efficiently, what will the average Joe on the street do? Manual labor will become obsolete. This has severe social implications for the economy of the future.

The implications of nanotechnology are stunning. Today's society might not be able to handle the rapid changes involved with the introduction of nanodevices into the marketplace. The government might try to halt the research until society was ready to handle the changes, but this is not the answer. Instead, we must press on with research, while at the same time address the future implications and have some answers for the future problems. This a lot to ask from today's researchers, but it is necessary to insure that this incredible discovery that has the potential to revolutionize life on Earth does not destroy it in the process.

NANOTECHNOLOGY

Mechanical Nanocomputers: Coming Full Circle

Charles Babbage and his co-worker Augusta Ada (inventor of computer programming) paved the way for mechanical computers. The computation machines Babbage proposed used brass gears and were large and difficult to build. The rules of logic Babbage and Ada used in their designs, are timeless and can be incorporated in an "intelligent" computer design system to aid engineers in conceptualizing a mechanical computer.

The student of dynamics has an understanding as to how a mechanical computer would function. Imagine a system of pulleys, as in fig #1. It is clear that if the cord is of a fixed length, then the length of X2 is a function of the length of X1, and vice versa. From simple analysis it can be seen that X2+2*X1=c, where c is some constant related to the length of the belt. In this manner, this system of pulleys can realize a function, namely that X2=c-2*X1. It is easy to imagine a similar machine with increasing degrees of freedom (more pulleys or cords), allowing any linear function of N variables to be constructed. This simple loop belt difference machine has been incorporated in adding machines in the past, but have severe limitations.

Brass gears and pulleys used as logical devices make a very slow and bulky computer. However, nanotechnology provides components a few atoms wide. Drexler, author of the book Engines of Creation, has calculated that a mechanical nano-storage device could hold 1 billion bytes of storage in a square box one micrometer wide. A cubic micrometer is about the size of a bacterium. The speed of such a device would be determined solely by the propagation time of the mechanical signals. Mechanical signals are about 10,000 times slower than electrical signals. However, because the device is built on the nano-scale, the distance traveled by the mechanical signal is about 1/1,000,000 as far as signals travel in today's computers. The net effect is a mechanical computer much faster than modern microelectronic computers.

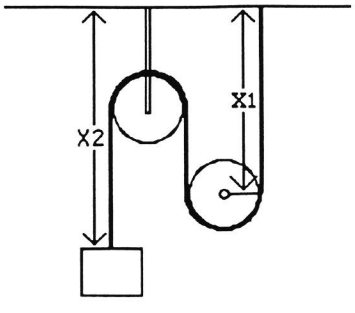


*Fig #1 A system of pulleys that realizes the linear function X2 + 2*X1=c.*

The nanocomputer of tomorrow would be composed of several basic building blocks. These include multiplicative and additive cells, and these represent ways that analytical functions can be represented through mechanical machines. Trigonometric functions can and have been represented in macro-scale devices knows as resolvers. The name resolver comes from "resolving a vector into rectangular components." Resolvers are more complex, but are mechanically determinable.

A nanocomputer modeled on a Von Neuman sequential machine, could be programmed with a "tape" of sequential instructions and operands. The tape would be a molecular chain, similar to DNA strings. The instructions from the string would be decoded by a nano-instruction decoder so the previously mentioned additive and multiplicative cells could be prepared for the appropriate operations. To control the process, a high level interface language would be compiled for execution by a nano-compiler. This nano-compiler would provide direction to a nano-assembler to manufacture the above mentioned molecular instruction tape, thereby completing the process.

Nanocomputers have the capability of revolutionizing the world as we know it. They will redefine what we now consider high speed, while at the same time occupy a fraction of the space. Electrical engineers should be aware of the dawning of the mechanical age of computing.

BABBAGE'S MACHINE

As an inventor of the analytical engine, the name Charles Babbage is fairly well known. The difference engine was Babbage's first idea to make a machine suited for the computation and printing of lengthy mathematical tables. After the culmination of this government sponsored project, he embarked on what became his great series of analytical engines.

A crucial step in the development of the analytical engine was the introduction in 1836 of a punched-card input system. Babbage's method of control cards consisted of three types: control cards, variable cards, and number cards. The engines were separated functionally into two principal parts, the store and the mill, much like the CPU and the memory of today's computers. The control cards controlled the mill, and the variable cards defined store addresses and operations in the store, such as read and write. The number cards held constants.

The analytical engines were decimal or base 10 machines optimized for rapid numerical calculation. The mill contained ingress and egress axes to hold numbers received from or being sent to the store. There were principal axes for calculation, each associated with a carry column. Control was organized by one or more "barrels", which were microprogram storages centers. There was also a set of registers, the table axes, associated with special purpose equipment for use in division. The analytical engines were the enunciation of the principles on which all modern computing machines are based.

THE SCANNING TUNNELING MICROSCOPE: NANOTECHNOLOGY IN ACTION

Today's technology is evolving towards the nanoscale. In the near future, electronics and machinery will operate in nanoseconds and be only a nanometer long. The nanometer, one billionth of a meter, is a unit of measure comparable to the sizes of molecules and individual atoms.

The scanning tunneling microscope (STM), can now function in the nanoscale. Gerd Binnig and Heinrich Rohrer of the IBM-Zurich Research Laboratories invented the STM in 1981. For this, they received the Nobel Prize for Physics in 1986.

The STM operates by using piezoceramic materials, which expand or shrink by a few tenths of nanometers, when a voltage is applied to them. Piezoceramic holders direct the tungsten tip of the STM to within a few angstroms of a conduction surface. Electrons from individual atoms tunnel out of electric potential energy wells in the conduction surface to reach the STM tip when a few millivolts are applied to the system. As the tip scans across the surface, the STM produces a topographical map of the scanned area. The map resembles a rocky plateau, with individual atoms appearing as boulders. This is the first device to resolve individual atoms.

STM tips can both "see" and manipulate individual atoms and molecules. Beckerm Golovchenko, and Swartzentruber of Bell Labs, reported in 1987 that the tungsten tip of an STM could move single atoms on the surface of a nearly perfect germanium crystal. STMs may improve germanium semiconducting devices by altering the crystal lattice.

The STM can also perform eclectic functions. In 1986, Schneiker proposed using STMs as atomic tweezers, Gigahertz acoustic modulators, electro-chemical synthesizers, and molecular recognition units. Fiber-optic interferometers could improve STM operations by calibrating tip positioning, overcoming creep, aging, hysteresis and electrical noise.

STMs may be used to develop molecular computing devices. In a related discovery in 1985, Yamamoto used a STM to build a molecular gear-bearing system that could rotate a billion times per second. Dieter Pohl and his colleagues developed a "biomorph-bender" in 1986 that could rapidly scan nanoscale arrays. Electrons deflected from an STM tip could etch nanoscale conductors for computers. STM tips could also drill nano-vacuum tubes into very thin metal sheets. In 1986, the Naval Research Laboratory began research into submicron vacuum tubes that could operate a trillion times every second.

Communication is another area that STMs could prove valuable. In 1985, Marks described how two 200nm metallic dipole antenna arrays could convert light into direct current with 75% efficiency. In addition to building these arrays, STMs could make nanoantennas from metallic tunnel junctions. These findings represent significant improvements over todays technology.

STMs display much adaptability and versatility in nanoscale operations. A simple ion milling process sharpens the STM tips to single atom points. A similar technique can generate atom-wide knife edges and other nanotools. Two tips made of different metals placed nanometers apart act as extremely accurate thermocouples, detecting extremely small changes in temperature. IBM researchers are now developing STM pipettes which can administer or detect individual molecules from a chemical solution.

STMs can also "touch" and "feel" atoms. They can place molecular levers next to atoms, molecules and ions. The STM tip can then measure Van der Walls electric forces which deflect the levers. Binnig, Quate, and Gerber have proposed to measure forces less than a quintillionth of a newton by this method.

Near-field microscopy will be enhanced by STMs. In 1985, Binnig described a method of making twenty nanometer holes in opaque metal films. These apertures overcome a fundamental problem, that light cannot be focused to a spot significantly smaller than the light's wavelength. When light passes through a tiny "nanoaperture" window, it is forced into a narrow beam. According to Pohl, Denk, and Lanz, a 1984 "optical stethoscope" could recognize 25 nm details when using 488 nw radiation. The optical stethoscope investigates samples with little damage since it can use longer, less energetic wavelengths.

The scanning tunneling microscope is but one example that nanotechnology is not a thing of the distant future. It is here today, and is finding many applications in present day research. Nanotechnology is opening doors that just several years ago appeared permanently closed.

See cover for illustrations of the STM

NANOTECHNOLOGY

FANTASY OR REALITY?

You Be the Judge!

Johnny Smith loves baseball. Nothing means more to him than pitching on Saturday afternoon's for his junior high school baseball team. Perhaps this is why Johnny seemed so sad as his mother drove past the baseball diamond. Johnny won't be pitching today because he has to go the doctor. Actually, Johnny has missed a few of the Saturday baseball games lately because he's been sick. It was a very quiet drive to the doctor's office. After all, it's not everyday that one finds out the results of a biopsy.

The results were not good. Johnny has leukemia, one of the worst forms of cancer. Mrs. Smith was grim and had plenty of questions. She asked the doctor in a serious voice, "How long will he be laid up and exactly how much will all this cost? He's not going to miss school Monday is he?"

What?! Oh, I'm sorry. I forgot to tell you that this is the twenty-first century and medical science has come a long way. Cancer has been cured, and in fact, all diseases can be cured. Everything from the common cold to AIDS are now only temporary nuisances. All of this is because of a new science called nanotechnology.

Nanotechnology is the engineering of atoms. Nano-engineers build extremely small machines out of existing atoms just as civil engineers build buildings out of iron beams, plaster board, and other prefabricated parts. In the late 1980's and 1990's, nanotechnology was a new science, but genetic engineers and other scientists recognized its potential.

Back in the twentieth century, scientists discovered that some cells were capable of detecting another type of cell and destroying it. White blood cells are perfect examples. They attack and destroy many of the harmful cells that enter our body. Scientists and doctors developed medicine which do the same thing. Penicillin, for example, attacks bacteria cells and prevents them from growing. The problem is that the development of these drugs was a process of trial and error. No one was sure if a drug would function until extensive and expensive tests had been run. Even then, unforeseen side effects still resulted. At this point, Johnny Smith's fate would have been the same as others of the day —he would have died.

Scientists had some large obstacles to overcome before they would be able to create molecules which would selectively destroy an invading molecule. At the time, they knew very little about molecular structure. During the 1980's, genetic engineers started work on mapping the structure of DNA and other complex molecules. This allowed scientists to develop a working knowledge base for the development of molecules for a specific purpose. This led to a new problem, the overwhelming amount of knowledge required to develop specific molecules. Artificial intelligence and supercomputers came to the aid of scientists. Computers with advanced expert systems, using the maps of molecules as its knowledge base, took the guess work out of creating new medicine. Computer simulations solved another problem which doctors encountered, the testing of new medicine. Extensive testing of molecular interactions under different conditions was done without ever endangering human or animal life. By simulating the testing of new drugs on molecules in our bodies, harmful side effects can even be eliminated.

After years of research, we can now develop a cure for a new virus in a matter of months. All that needs to be done is to map the new viruses' cell structure and enter the data into our existing knowledge base. It is then just a matter of engineering the best molecule to do the job.

Nanotechnology surrounds Johnny Smith and all of us in the twenty-first century. Not only is it used to destroy dangerous cells, it is also being developed to reconstruct unhealthy ones. In fact, nanotechnology extends into almost every area of engineering, science, and medicine. Johnny Smith and his mother are glad they live in the age of nanotechnology. However, Johnny may not think that on Monday, the day of his science exam.

NANOTECHNOLOGY

Discover How Nanotechnology Will Change Your Future!

Nanotechnology will be able to revolutionize the field of medicine because it operates on the very atoms of which the body is composed. If we consider a sick, injured, or elderly person as a collection of disorganized or damaged atoms, a nano-machine will be able to rebuild or rearrange these atoms to recreate a healthy individual.

Several types of nano-machines will be necessary to accomplish these goals. First will be a disassembler and a nano-analyzer. A disassembler is a device that can separate the cell into its component parts. When the disassembler is connected to a nano-analyzer, and turned loose on samples of molecules, it will classify each of the pieces and store the results. This will in effect map what the healthy cell structure of the human body should look like. Known virus and disease structures will also be mapped so as to be readily identifiable. This data as referenced by a nanocomputer will serve as the core of the cell repair machine.

The cell repair machine will contain several components. At the core of the machine will be a nano-computer that will contain the data compiled by the disassembler, and direct the actions of the repairs. Next will be a link to "touch" a cell or molecule and attempt to match its structure to its database. If the piece is healthy, it will progress to the next piece, and analyze it. If it determines that this component is defective, it will determine what structure should be at this location by searching its database and comparing the adjacent structures. Then it will attempt to repair or replace the defective component. Chances are that the defective component is a small portion of a cell, and a disassembler will remove it, and break it down to its component atoms. A replicator will then reassemble these atoms to form a healthy cell once again.

This entire machine will take up a space .2% the size of a cell. Because of this extremely small size, they will be able to permeate the cell wall, and be able to repair each component individually. Also, thousands of repair machines could be operating on an individual cell simultaneously. In practice an individual could be injected with millions of these devices while healthy. If any cell, or fraction thereof, became irregular it would be repaired before any substantial damage could be done.

To aid a sick or injured individual, millions of these devices would be injected at the point of injury. The repair machines would be set with timers so as to deactivate themselves after the repairs were complete so they would not clog up the person's system. In this manner, a healthy individual would not have to worry about becoming sick, while a sick individual would have faith that they were on their way to recovery.

Consider three applications of the above stated device. First, the most basic type of illness, an invading virus. If, as the repair machine was while patrolling the body, it encountered a virus, it would identify it as such, and disassemble it. The body would output the remains as waste. Secondly, consider a cut on the skin. The victim would spread a cream containing millions of repair devices that would rejoin the separated capillaries and remove any scar tissue, and finally reform the skin so as to obliterate any sign of the abrasion. This process could also be used to regrow entire limbs that became damaged. In this case, the repair machines used could be more smaller and more effective because they could be designed to only repair skin and blood vessels, and not fight every known disease.

The third example is perhaps the most interesting, that of aging. With millions of ideal cell repair machines circulating the body, they would be able to keep a body healthy for perpetuity. By repairing damage as it happens, old age could never "set in" and a person could stay fixed at any age that he or she desired.

These are but three of an endless list of the possible applications of such a device. In the beginning these devices will be virus and disease destroyers, and would allow the body to repair itself by destroying the cause of damage. They would be the perfect surgeons, by removing a damaged area atom by atom, without damaging the neighboring tissue. As soon as the definitive map of the human body could be compiled, the true nano-repair machines would be operative. They would circulate the body on constant alert for mutations or irregularities. No disease could survive with such an active defense system. This is not to say that all death would be avoided, but that death would be limited to death of the brain. As long as the brain functioned, the body could be rebuilt, regardless of the damage. Do not expect to see these devices at you local drugstore tomorrow, but when you begin to see them in the next decade or two, don't be surprised at the results.

About the Honors Research Program

The Honors Research Program, is an interdisciplinary program which allows interested students, who meet sufficient academic requirements, to team up with a professor and pursue an area of mutual interest. The student selects a research topic and solicits the help of a professor to serve as his or her advisor. Over the course of three semesters, the student-faculty team explore this area for mutual benefit. A second facet of the Honors Research Program is the once-a-week seminar where participating students meet to discuss the progress of their projects and current events topics which relate to engineering and the sciences. Upon completion of the program, the student receives a certificate and nine credits, as well as a wealth of knowledge in a concentrated area of study.

The following is a listing of the participants in the program and the projects they were pursuing at the time:

Errol Arkilic
A Fluid Mechanics Analysis of Losses in a Rotor Working in a Vaneless Diffuser
Raymond Johnson
Evaluating Parallel Vision Algorithms on Various Network Configurations
Sangbeom Kim
An Introduction to Contour Coding
Daniel Korn
The Performance of a Surge Arrester in a Lightning Induced Surge
Glen Popick
An Introduction to Speech Coding
Roberto Rodriguez
Measurement and Imaging of Biomagnetic Fields
Todd Snouffer
Application of Computer Controlled Materials Testing to Rate-Sensitive Materials
Patrick Wamsley
VLSI Full-Adder Using Recursive Generate-Propagate System
Thomas Woolston
Neural Networks and Pattern Recognition Using Back Propagation

For more information about the program, or to find out how you can get involved, please call Dr. Jones at 994-6929, or contact your academic advisor.
Final project presentations for Spring 1990 will be given on May 10, from 4:00-6:00 PM in the Academic Center, 7th floor conference room. All are invited to attend.

'It gave me the opportunity to learn about something which interested me, and was not in the curriculum.'

Faculty Page

Sarkani: A Stabilizing Force in EARTHQUAKES! Engineering, That Is!

Dr Shahram Sarkani, Professor of Civil Engineering at GWU 1986-present.

Interview By Taraneh Amin

Dr. Shahram Sarkani received his Ph.D. degree from Rice University in Structural Engineering and has been an assistant professor of Civil Engineering at GWU since the fall semester of 1986. He is the author of more than twenty technical papers and presentations and is an active member of the American Society of Civil Engineers Committee (ASCE) on Fatigue and Fracture Reliability. His present research is mostly concentrated in the areas of stochastic structural fatigue, supported by the David Taylor Research Center and in earthquake engineering supported by the National Center for Earthquake Engineering Research. The following paragraphs represent comments made by Dr. Sarkani relating to the field of earthquake engineering. Read on:

In the area of earthquake engineering, we are interested in understanding the behavior of non-load carrying members in the structure. Non-load carrying members, also referred to as secondary systems, include stairways, doors, bookshelves, piping system, ventilations system, and so on.

Generally speaking, we have a good idea of what happens to the building itself during an earthquake. The secondary systems' behavior, on the other hand, is not well understood. We want to know what happens to them during an earthquake, so that we can prevent their large deformation and/or acceleration during an earthquake.

Let's take the emergency room in a hospital for example where you have beds and medical equipment. You don't want to anchor them very tight because they have to be mobile, yet you don't want them to start going in every direction during an earthquake. Another similar situation would be in protecting the valuable and expensive super-computers found in a building.

We have found a number of ways to protect them :

One way is to place them in certain locations in the building. Different locations in a building are different in the degree of safety they offer during an earthquake since different locations throughout the height of the building have different characteristics in terms of how much energy will be delivered to the equipment. Given a building, we have a good idea of what place the the building will experience the least acceleration and deformation, and we place our equipment there.

The other way would be to isolate the valuable equipment by using support conditions so that we can reduce the acceleration that is transmitted to them. For example, we can change the vibrational characteristics of the equipment (damping, stiffness, ...) by modifying the support system of the equipment, such that the response of the equipment is reduced substantially. Certain equipment have a frequency close to that of the structure. If this is the case, you will have the tunning effect and the equipment would respond pretty severely. Sometimes, we have to isolate equipment using material such as rubber padding.

So as you can see, there are a number of ways in which we can protect equipment if we understand their dynamic behavior. So we are doing this research, supported by the National Center for Earthquake Engineering Research, to try to establish guidelines that can be used by design engineers.

The second area of research which I'm involved is supported by the David Taylor Research Center, one of the research arms of the U.S. Navy, and it has to do with fatigue. If a structure is subjected to a time dependent loading, then it may fail due to fatigue. For example, waves will hit an offshore platform of a ship day after day and eventually they will create fatigue cracks, the cracks will grow and eventually the structure will fail. Most structures will fail, not by a severe wave or wind, but by the accumulation of damage due to many waves throughout its service life.

I am primarily interested in fatigue failure of marine structures and trying to understand the mechanism behind this failure. These structures are composed of many welded members. There is a lot of stress concentration in welded area and fatigue cracks always start at the welds. We want to know what causes the crack to grow and how we can prevent it. Again in order to prevent something, you've got to understand it.

Faculty Page

Edited by Chong Bum Lim

First, we are trying to understand how long it takes before a given member fails due to the loads that are created by waves. We do both experimental and theoretical work. In the experimental part, we use a welded joint which resembles a prototype joint in a given structure. In the laboratory, we simulate a wave loading and apply it to the joint until the joint fails. We have some mechanisms in which we can determine what the damage is due to each segment of the loading. For example, we can determine what the damage is due to one hour of loading. Then we can add up the damage and when it reaches a critical value we say that the structure will fail. We hope that our theoretical models are predicting the same results as those seen in the laboratory. In many cases, the laboratory models fail sooner than our theoretical models are predicting. Of course, there are a lot of different loadings that a marine structure will be subjected to depending on the wave conditions, sea state, severe storms, frequency of the structure, and the speed and the direction which the ship is moving. All these interact in determining what exactly happens to a joint in a structure. Generally, we can have a pretty good idea of the loadings those members experience and simulate it in the laboratory. We try to differentiate between the loadings in terms of fatigue damage they can cause. So, we want to look at the loading itself and determine its damage capability in terms of fatigue.

The first time I was introduced to this problem was when I was a graduate student at Rice University. We studied various models which people used to predict the fatigue life of a given structure and we found out that the laboratory results don't match the theoretical predictions. The more tests we ran, we noticed that the results could go either way. In a lot of cases, the experiments lasted longer than the model predicted, making the structures designed based on the theoretical model inefficient. In some other cases, it would take one third of the predicted theoretical time for a structure to fail in the laboratory. If it always took longer to fail in lab, it could be modified easily by introducing a factor of safety. The worst case would be a structure that is strong one day and weak the next. We have to find out why this discrepancy exists. Furthermore, we want to have theoretical models that are simple enough so those in industry can use it. The challenge is to understand the problem and come up with design guidelines that are simple and practical. There are still many unknowns in this area of research and it is going to be a long term project.

The aftermath of the biggest US earthquake [Oakland, Calif, 1989] since 1906. (Newsweek)

Alumni in Focus!

Dr. Norris Hekimian

SLAYING GIANTS

Interview by: Jeffrey L. Dion and Nelson M. Kee

"Singer Lainie Kazan did it, and the phone company caught her. Actor Bob Cummings says he didn't do it, but telephone-company detectives and the police say they caught him redhanded." This is a quote from the front page of the January 29, 1976 issue of the *Wall Street Journal*. These celebrities were using what is known as a blue box to make free long distance calls. This pocket-sized electronic device which cost up to $3,500 cost the phone company an estimated $10 million to $20 million a year in the 1970's. However, a device known as the Hekimian Dialed Number Recorder helped nab these blue box users, or "phone phreaks" and helped to alleviate the problem. The device was developed by Hekimian Laboratories Inc. of Gaithersburg, Maryland, whose founder was Dr. Norris Hekimian, a graduate of the George Washington University Engineering School in 1949.

'When you have giants stepping on your throat, it's hard to breath.'

The blue box enables callers to mimic the thirteen tones which long distance operators use to connect lines. Ten of the tones represent the digits 0 - 9, one tone informs the switching equipment that the line is clear, another tone indicates that the dialing is about to begin, and the last tone signals that the call has been completed. Recordings of these same tones will also work. Ironically, it was a 1960 AT&T technical publication which revealed what these tones represented. In order to make free long distance calls, the "phone phreak" dials a toll free 800 number or calls an out of town phone operator. When the call is answered, the line is seized by using the clear tone. The "phone phreak" will then indicate that a call is about to be placed, dial the number, and indicate that the call has been completed by entering the appropriate tones into the phone's mouthpiece. Although the AT&T computers kept track of all the calls made, the caller was not charged since the billing equipment considers the call to be free. Suspicious calling patterns were investigated by placing the Hekimian Dialed Number Recorder on the suspect's line. The recorder distinguishes regular calls from illegal blue-box calls and prints out each number called. As a result, Lainie Kazan was fined $440, placed on 18 months of probation, and paid $300 restitution to the phone company, while Bob Cummings was charged with two misdemeanors. This is just one of the interesting anecdotes which Dr. Hekimian shared with us in a recent interview. He remarked,"It's not every day that you get on the front page of the Wall Street Journal."

The following is the story of one of GWU's most distinguished alumni. Dr. Norris Hekimian has received many awards including the Engineering Alumni Achievement Award and the Distinguished Alumni Award. He has also held many prominent positions including Bureau Chief of the National Security Agency, Assistant Director of Research of Page Communications, Director of the Corporation for Technical Training for Montgomery County, and President and CEO of Hekimian Laboratories. He is currently an Alumni Trustee and has donated generously to SEAS. His career is one in which many engineers hope to one day emulate.

Communication technology began to blossom in the late sixties. In 1967, the Carter v. American Telephone & Telegraph Company decision allowed many to get in on the ground floor of this growing technology. The decision gave parties other than the phone company the right to connect equipment to the lines, provided that they were not damaging. With this decision at hand, communication took on a whole new look. Data could be trans-

Alumni in Focus!

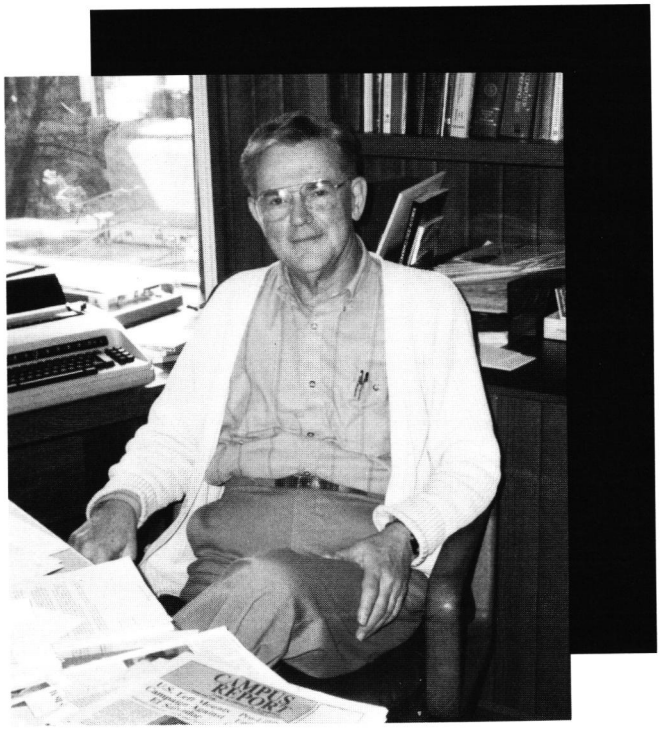
Dr. Norris Hekimian

mitted from one location over the lines to a receiving location at 300 bits per second. With the increased use of telephone lines as a data medium, the quality of transmissions had to be better than ever. Inevitably, problems arose. One major problem was that of timing jitter, where the output signals were not the same as the input being sent.

A colleague approached Norris Hekimian about this problem. Working out of his basement, Hekimian began performing tests and analysis on the distortion of transmitted signals. Hekimian concluded that timing jitter resulted from the method with which data was transmitted over the telephone lines. In the latter part of 1969, Hekimian developed an instrument to measure the amount of time jitter, called the phase jitter meter. As the use of telephone lines grew, the problem grew, along with the demand for his device. In 1970, Hekimian received his first contract for 35 phase jitter meters from NASA. By that time, he had formed a small company with hopes of expanding. During this time, he had day-to-day fears that larger instrumentation companies, such as Tektronix, had introduced their versions of phase jitter meters. Reflecting back, he said, "When you have giants stepping on your throat, it's hard to breath."

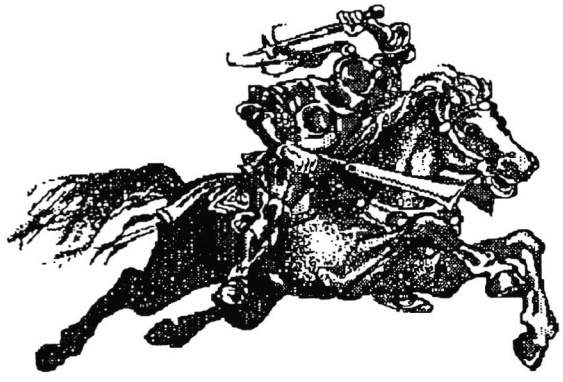
As data transmission became even more popular in the 1970's, there was an increasing need for instrumentation which could locate and identify the growing number of problems. The birth of Hekimian Laboratories, Inc. in the 1970's resulted from the time and devotion spent solving these new problems. Hekimian said, "The phase jitter meter made us; it took us from the small time to the medium time." So much so that competitors declined to develop their own version of the phase jitter meter since Hekimian Laboratories had captured 95% of its market.

In 1983, Dr. Hekimian sold the laboratory which still bears his name.. When asked about his proudest accomplishment, Dr. Hekimian humbly responded, "I'm proud of a business with a good reputation that supplies jobs for 300 people." Dr. Hekimian still travels once every couple of weeks to the laboratory to fulfill his position of Vice President of Research. He will continue to hold this position until June of this year. By following his motto for survival, "being willing to and having the common sense to change from the past," Hekimian Laboratories will continue to grow well into the twenty-first century.



Dr. Norris Hekimian, A Distinguished GWU Alumnus, 1949.

'Being willing to and having the common sense to change from the past is the key to survival.'



Alumni in Focus!

Edward F. Mitchell

A Familiar Face at PEPCO

Interview By: Chong Bum Lim

'That was the beauty of the M.E.A. degree . . . at G.W., you can work the same time you go to school.'

At the G.W. Winter Convocation held in mid February, President Trachtenberg conferred the Distinguished Alumni Achievement award to Mr. Edward F. Mitchell, an alumnus of the School of Engineering and Applied Science (SEAS). Mr. Mitchell is not an unfamiliar face to us for he also spoke at the SEAS Commencement in May of 1989 where upon he also received an honorary Doctorate of Sciences degree. He is an active member of the SEAS Alumni Association and is one of several alumni who have distinguished themselves through their achievements and actions.

Mr. Mitchell received his Masters of Engineering Administration degree at G.W. in 1961 and is now the Chief Executive Officer (CEO) of the Potomac Electric Power Company (PEPCO), a company he has been with for almost thirty-four years. I had the privilege of speaking to him at his top-floor office at 1900 Pennsylvania Ave., barely 2 blocks from Tompkins Hall.

Mecheleciv: Mr. Mitchell, let's start from the beginning. Where were you born?

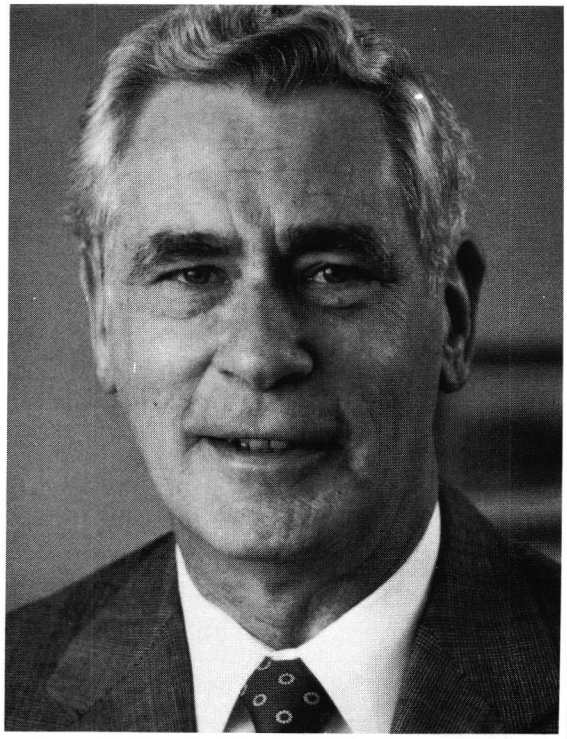
Mitchell: In the Shannandoah Valley, Harrisonburg, Virginia.

Mecheleciv: Where did you go for your undergraduate studies?

Mitchell: I went to the University of Virginia and majored in electrical engineering. I graduated from there in 1956 and I came to work with PEPCO. And largely because of the educational opportunities that existed in the area, with all of the major universities here, and since we were very close to G.W., I decided to go there for graduate work.

Mecheleciv: So while you were working you attended G.W.?

Mitchell: Yes, that was the beauty of the M.E.A. (Master of Engineering Administration) degree and a lot of the courses at G.W., you can work the same time you go to school. And that was very helpful, most of the classes being in the evening.



Edward F. Mitchell, SEAS 1961 Alumnus, CEO of PEPCO.

Mecheleciv: How did a M.E.A. from G.W. help you?

Mitchell: When you study engineering there is a tendency to focus very strongly on the technical aspects, obviously or else you would not get through engineering school. And after that, it is helpful, whether it is a M.E.A. degree or law or whatever, to do something in the academic field different to help broaden your scope, look in a different direction, get a better feel for what the business world is all about. And so the M.E.A. was very helpful.

Mecheleciv: How did you first start out at PEPCO.

Mitchell: I started out as, what they used to call, junior engineers. It was in June 1956 and I think the going level of compensation back in those days was about 95 dollars a week. Of course, the starting salary for engineers today are ranging somewhere on the order of magnitude of $32,000 or so. Quite a big difference there...

Alumni in Focus!

Edward F. Mitchell

Mecheleciv: Were you planning to go into a management position?

Mitchell: No, as a matter of fact what I was thinking about in the early days was to go into the nuclear program. Nuclear was really growing in the mid-fifties and it was the up and coming thing. But between the time I left undergraduate school and got into the graduate program, I changed my mind that, that was not exactly what I wanted to do. The business world seemed to have more appeal than did the nuclear world. I really liked the business world and the business features of it.

Mecheleciv: Eventually by rising through the ranks you became president in 1983 and then CEO in the September of 1989.

Mitchell: Yes that is correct.

Mecheleciv: I understand that you are also very much involved within the Washington community. Could you explain the work done by the Corporation Against Drug Abuse.

Mitchell: It is an interesting organization. In 1987, we did a study of the metropolitan city to determine what the impact of drug abuse in the area. Now today as you look back on it, it sounds like a rather foolish task because it is so apparent by what is happening now. But it was not apparent several years ago. The study we did region wide.. [of] the entire metropolitan... showed that we had a very severe drug problem that people didn't fully grasp; they didn't understand how bad it really was. And the indications were, when we released that study, that crack cocaine was just beginning to be introduced into the region and it was apparent that we had the potential for an explosion of drug abuse. And indeed that is what happened.

And as a response to that ,the Federal City Counsel Board of Trade, the Greater Washington Research Center and the Community Foundation all helped form the Corporation Against Drug Abuse. Our purpose was two to three folds:...Part number one was then to get into the work place to set policies and guidelines and give help to the various companies. The way we went about that was to create visiting teams of lawyers and human resource people that will go into a company at their request and meet with them and help them develop policies, practices and procedures; set up employee assistance plans and in fact get to the population through the work force. ... Number two was to try to develop a prevention program that would be helpful.... Over a year we set up what we think is the workable process that puts into place in the grade schools...a drug prevention program that brings into place; business, the educational systems, enforcement officers, not from the enforcement standpoint by from the standpoint of prevention, the court system, media, parents, students. It brings everybody together in the community as a drug prevention program... This program is actively being put into place in at least two schools in D.C... We have also worked with other areas [of drug prevention]. Another objective was to try to put into place the gathering of data measuring system within the metropolitan area.

Mecheleciv: What qualifications or qualities do you think were most needed in your career?

Mitchell: The greatest thing that anyone in any business needs to focus on is people: the people you work with, the people you work for, and the people you serve. No business can function without people. People make the business work and make it run and you must be able to get along with and do the best you can to understand what other people think and feel. That is a difficult thing to do, but it is something that one must develop or at least work on to the greatest of one's ability to understand, to feel and to recognize the impact that a decision might have on others. I think a genuine concern for people and an acceptance of the work that you are doing is needed. You must like what you do and hopefully it is directed to something good. Our business (PEPCO) is service... it is a vital service to the extent that it is critical to our society and makes it better. You can see that your service is being used, recognized and is needed.

Mecheleciv: It is a great program.

Mitchell: Yes, it is a tremendous program. I would like to see every city,every business have something like this but it is very difficult; it takes an awful lot of effort.

Mecheleciv: Do you have any words of advice for us students?

Mitchell: It is very difficult to advise anybody... the only thing that I will say to anyone is when you begin a course a study , do the best you can...it is good discipline and good personal training.

Mecheleciv: In retrospect, did you ever imagine that you would be where you are now, sitting in this office?

Mitchell: No... Absolutely not. That is one thing, I guess I never did... some career counselors recommend that you set goals for yourself. I couldn't

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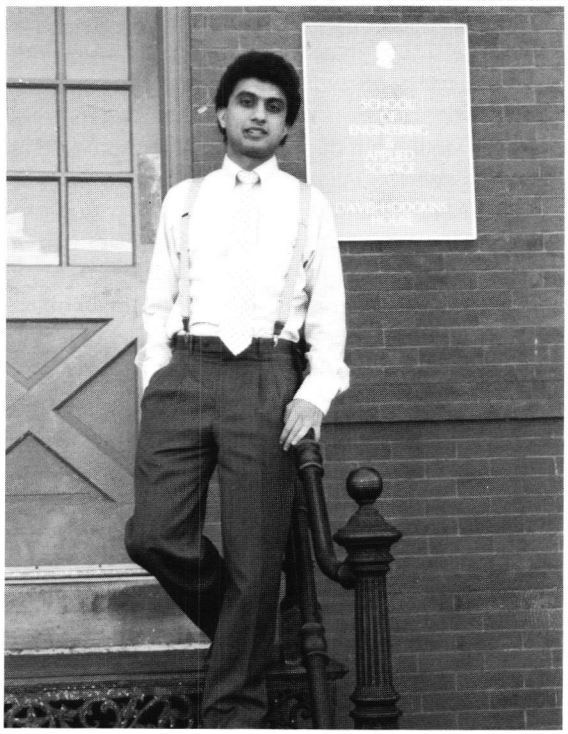
'The greatest thing that anyone in any business needs to focus on is people, the people you work with, the people you work for and the people you serve; no business can function without people.'

In Step with Javid Sonde



Javid Sonde, Engineers' Council President 89-90.

Interview by Bobby Makheja

Veni! Vidi! Vinci! He came, he saw, and he conquered! No this is not Julius Caesar, but could it be his soul reincarnated into the body of the Engineers' Council President Javid Sonde. Having a B.S. degree in Mechanical Engineering and currently working his way towards his Masters degree in Engineering Administration at GWU, Sonde has already assumed good stature in the engineering school. Within a year and a couple of months stay in the U.S., he has held several leadership positions in different campus organizations, and Sonde plans to keep marching on!

'. . . it was the difficult part that made me work much harder to change some of the things in the Council that have not been changed for years.'

In recent news, Javid was awarded the Baer Award, at the fifth annual Excellence in Student Life Awards ceremony on Friday, April 13th. This award represents Javid's commitment to the GW community on the whole, not just the engineering school.

When posed with some questions for this article, he had this to say:

Mecheleciv: What was the most difficult task that you had encountered as president?

Sonde: It was gaining the trust and confidence of his colleagues and administration.

Mecheleciv: Do you think you have overcome this?

Sonde: Most certainly so! It was not easy, but I think a lot more people understand me better now, than they did earlier. The shadow of doubt has slowly given way to clear skies, and I definitely feel that I have quite successfully, in a subtle way, worked to progress in this area.

Mecheleciv: What input do you have about the present Council?

Sonde: I should say, that by far it was the most diverse, in terms of cross section of people. At times it made the task difficult, but definitely made it more challenging. In fact, it was the difficult part that made me work much harder to change some of the things in the Council that have not been changed for years. As president, let me remind you, there is only so much you can do. Also, my tenure at the council has been very educational to me and to my fellow students at SEAS. For the students, I can proudly proclaim that there are more students who now know and understand about the Council and the existence of the D.H. House, than there was in the past.

Mecheleciv: What do you feel you have personally contributed?

Sonde: When I ran for this position, I had promised my support to all engineers on campus, especially minority engineers. One such example is the founding of the Korean Engineering Students' Association this semester. To further work closely with the Black Engineers Society, I enrolled myself as a member. I have spent several long hours talking to female engineers about the Society of Women Engineers on our campus.

Mecheleciv: What's next? What do you have planned for the future?

Sonde: Can anyone tell? It could be anybody's guess. Maybe another degree in engineering or maybe as president of my own business. It's left

In Step with Javid Sonde

to be seen, but one thing I am confident and positive about is, a bright future—something to make GWU proud of me.

Mecheleciv: If given another shot at education, would it be at GWU?

Sonde: Most definitely so! There's no other place that I'd rather be, by choice. This is, by far, one of the best schools in this area. The education is perfect. Look at the geographic location of this school and the superb blend of American and international students. My experience at this school has helped me to enhance my understanding of other cultures.

Mecheleciv: What is that one thing you would like to see in the Engineering School?

Sonde: Like all other professional schools at GW, I would like to see the SEAS have its own library. Our discipline needs severe concentration, a good reference library, and more essentially the grouping of similar minds in study sessions. This can be achieved only if we have a space of our own, however small this space may be. With one step at a time, we will have our very own library. A strong Alumni, along with the administration and students working hand in hand can make this possible.

Mecheleciv: How do you view the Administration?

Sonde: They are like parents, they want the best for us. However, this does not mean that they are always right. We must remind them, as we do our parents, that we don't necessarily view things as they do. Opinions should be voiced. I have known the administration as being open to student problems. A sound proposal can never be ignored. With a collective voice we can always do something about the way changes affect us.

Mecheleciv: Any last words?

Sonde: I just like to remind all of the famous quote, 'United we stand, divided we fall.'

'I have known the administration as being open to student problems. A sound proposal can never be ignored.'

With this, he smiled and winked with a thumbs up sign as though saying, 'I know we will get there——soon!' We at the Mecheleciv know Javid will fare well wherever his travels take him. Good Luck!!!

continued from page 15

do that; I have never done that. I think whatever job you have, you do the best you can with it. For me, I was very lucky; it worked out very nicely.

Mecheleciv: Mr Mitchell, thank you very much for this interview.

Mitchell: It was my pleasure.

Mr. Mitchell is also very active within the local community. He is a member of the many board of directors, including those of The Riggs National Bank of Washington, the National Rehabilitation Hospital, the National Capital Chapter of the American Red Cross, and the Greater Washington Board of Trade. He is the chairman of the Corporation Against Drug Abuse which sponsors a great number of important and effective programs.

Moreover, he is a well-respected business leader who is genuinely concerned with the quality of life in the Washington area. Mr. Mitchell, we from the Mecheleciv magazine would like to congratulate you on your receiving the Alumni Achievement Award and wish you the best of luck in all your endeavors.

RUBE GOLDBERG DESIGN CONTEST

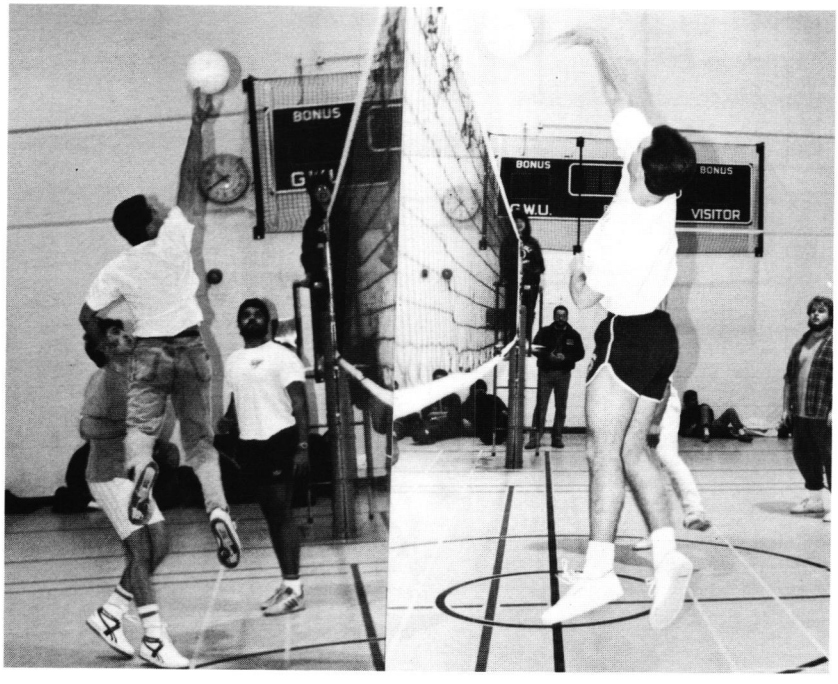
'The Rube Goldberg Contest was a welcome addition to Engineers' Week.'

By Cecile Silvestre

What would you do with a roll of toilet paper, clips, mouse traps, and straws? No other contest required so much imagination and ingenuity in an engineer than the Rube Goldberg contest sponsored by Theta Tau and the Engineers' Council. The object of the contest was to build a device that performed a specific task. Contestants were divided into teams of three. A bag of supplies were given to each team that would enable them to come up with a device. Two separate tasks were assigned that each required two different devices. For each job, a team was allowed two trials to complete it. The first task was to aim an object at a specific target from a certain distance. The winning device, built by Jeffrey Dion and Rosihan Jaafar, was a series of continuous motions that consisted of: roll of toilet paper rolling off from a platform, falling down on a mousetrap, the snapping of the mousetrap sent the object into a projectile motion and landing near the target. This task was judged on ingenuity and accuracy to the target. The second task was to build a vehicle that must travel on two parallel wires that were a foot apart and 20 feet long. This vehicle must travel as far as it can across the wires and must transport an egg and drop it into a box on its second pass across. One device was constructed by Mike Livingston and Kelly Boos. Their vehicle was made up of thread spools as wheels connected by a wooden rod was propelled by inflated balloons that deflated as the vehicle traveled across the wire. However, they were soon to be defeated by the winning design of Chong Bum Lim and Yens Yohanson that used rubber bands and springs to construct a sling-type propelled vehicle.

Volleyball, Engineers' Style

A Smashing Success

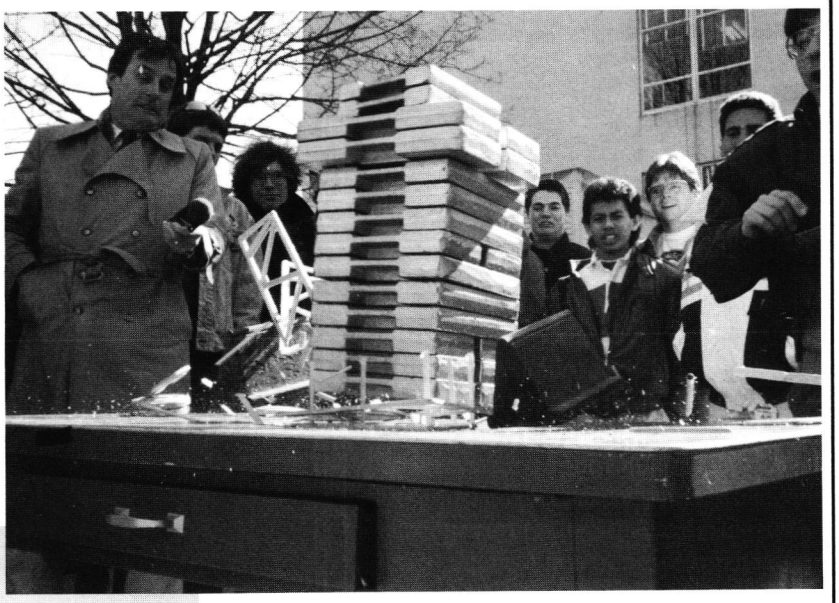


Engineers show their competitiveness on the court.

Many commented that this year's Engineer's Week volleyball tournament was the best it's been in years. Ten teams of various majors, nationalities, and abilities participated. However, the common thread that tied these students together was a desire to have fun and to be with other engineers. After all was said and done, one team was left standing — UAE2 (United Arab Emirates 2) and they had there brand new SEAS sweatshirts to show for it. Thanks to the efforts of Theta Tau, the Engineering Fraternity, and sponsorship by the Engineer's Council, this year's volleyball tournament was a smash.

The volleyball competition and Rube Goldberg design contest were sponsored by Theta Tau, the engineering fraternity. For more information about Ø T, contact Chris Goldsmith at 994-9745, or 994-9738.

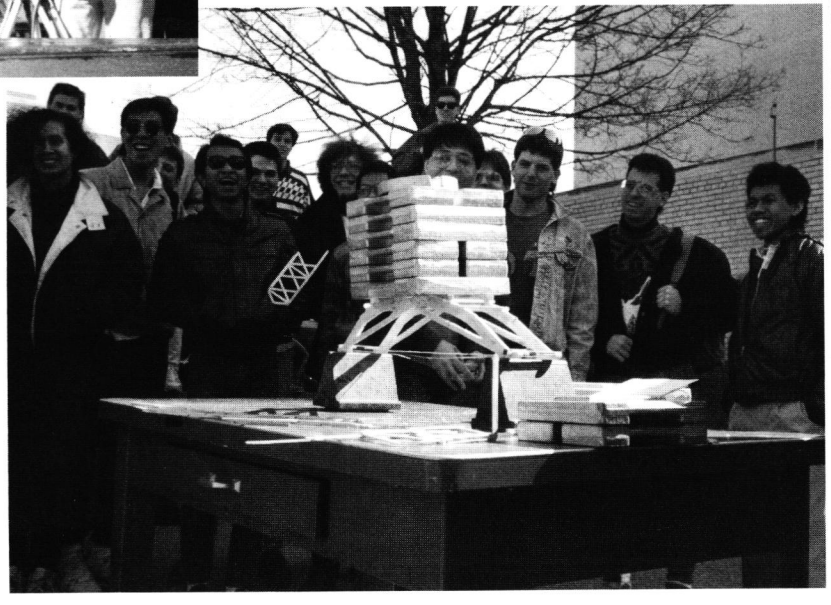
ENGINEERS'



BRIDGES, BRIDGES, AND MORE BRIDGES

A crisp, sunny winter afternoon was the setting for the kickoff of Engineers' Week. On Tuesday, February 20th, the popsicle stick bridge contest sponsored by the American Society of Civil Engineers took place in the parking lot at the northern entrance of Tompkins Hall. Twenty anxious engineering students crowded around a sign-up table to register their bridges.

Two dozen spectators looked on as Professor Sarkani, from the Civil Engineering Department, loaded the bridges one by one with steel weights. After nearly an hour of loading the bridges to capacity and watching them break and splinter to pieces, the winners were determined. Reza Vassetizadeh, a senior civil engineering major, took first place. His bridge supported 280 pounds and earned him the $100 first place prize. Second place went to Jill Shauer, a civil engineering junior whose bridge held 220 pounds. She received $60. There was a tie for third place between Jeff Dion and Rosihan Jaafar bridge and that of Kevin Groot's with a weight of 160 pounds. All three are mechanical engineers and received $40.



WEEK 1990

ENGINEERS' EGG DROP

Jeffrey L. Dion

With another Engineer's Week upon us, it was time to raid the chicken coups and head over to Tompkins Hall for the annual Egg Drop Contest. The sky was overcast with a chance of rain, but that didn't stop these engineers from coming out and giving it a try. The Egg Drop Contest has become a tradition at GWU. The idea is to design and build an egg drop vehicle, which can sustain a fall of 67 feet from the roof of Tompkins Hall. Contestants whose egg survives the impact with the concrete below are assigned a score based on their weight, time of fall, and distance from the target. The only rules were that the vehicle must not weigh over 750 grams, have a length greater than 60 centimeters, or be remotely controlled.

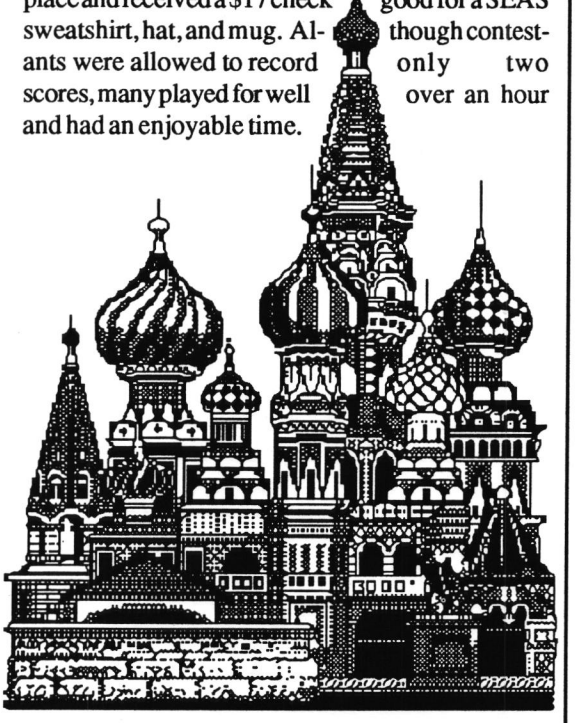
In previous Egg Drop competitions, problems have arisen with the timing mechanism used to calculate the descent time of the vehicle. There was no such problem this year, as a state-of-the-art timing system was developed by Professor Kaufman. It consisted of three individual timers, with an average taken from the two closest times and the furthest deviation being trashed. After each drop, the contestant's vehicle weight, distance from the target, and average fall time were entered into a computer spreadsheet to calculate the "win factor."

The winner of this year's Egg Drop, with a "win factor" of 550, was Ghuasson Alami who is a junior majoring in mechanical engineering. His design was a conventional rocket with fins on the tail for stability. When asked about his key to winning Ghuassan replied, "I wanted to maximize the length to get the most aerodynamic I could." Todd Snouffer, a senior mechanical, came in second place with a score of 599. His vehicle was considered the most attractive and he used a clay nose which stuck to the concrete on impact. In third place with 669 points was Jeff Dion, a junior, and what do you know, another mechanical. His design was rather unique in that he used marshmallow (also known as Fluff), to absorb the impact. However, the most unique design was turned in by Professor Kaufman. His entire vehicle was made out of food. His egg didn't have a chance as it scrambled on the concrete after his homemade triscuit (yes, the crackers) module descended to its death.

TETRIS

By Pete Campbell
Eta Kappa Nu Secretary

The TETRIS Contest, sponsored by the Eta Kappa Nu Association (EE/CS Honor Society) and the EngineerS' Council, was held on Thursday and Friday of EngineerS' Week. The object of the contest was to obtain a score on TETRIS that was closest to an *unknown mystery score*. TETRIS is a Soviet computer game that involves logic and rapid decision-making. The scores of the 37 graduate and undergraduate contestants were recorded and compared to the mystery score at the end of the contest. Athena Caul won first prize with a score of 2752, 11 points off of the mystery score of 2741 points. She was awarded a $100 check for a Nimtendo Home Entertainment System. Second place went to Kevin Groot (2795) who was awarded a $50 gift certificate to Tower Records. Jay Newlin (2639) won third place and received a $17 check good for a SEAS sweatshirt, hat, and mug. Although contestants were allowed to record only two scores, many played for well over an hour and had an enjoyable time.



We Had A Ball!

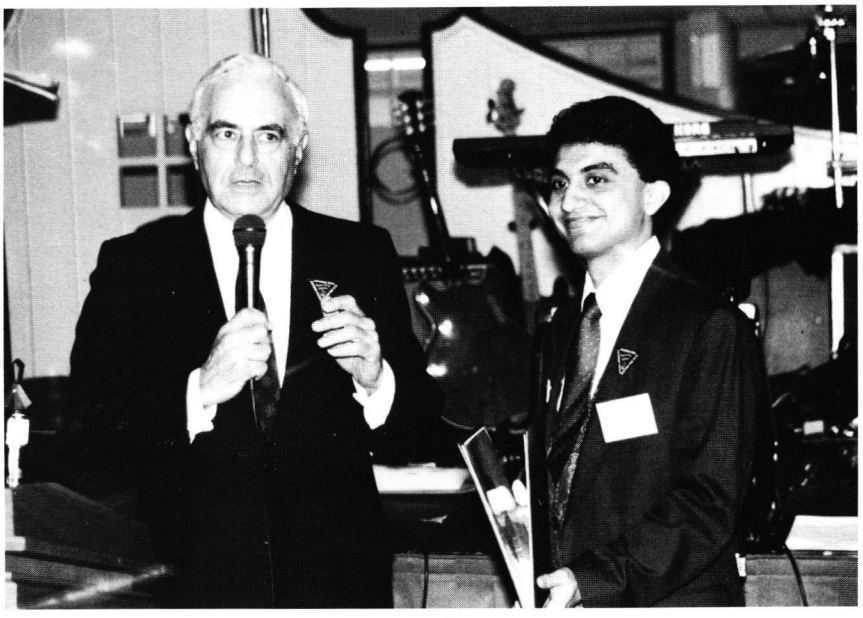
By Bobby Makheja

What a better way to end an exciting 1990 Engineers' Week than with the 60th Annual Engineers' Ball. This historical tradition held Saturday February 24, 1990 at the Grand Market Place, George Washington University was a grand celebration. The Dean, faculty, alumni, students, and guests gathered as a symbol of the School of Engineering and Applied Science's unity. A long list of honored guests which included Mrs. Gail Short Hanson, Dean of Students, and John David Morris, President of GW Student Association, graced the Ball with their presence. In addition, chairpersons from almost every engineering and applied science department attended this event with enthusiastic support.

As the Ball opened, the Master of Ceremonies, Bobby Makheja, welcomed everyone and directed them to the exotic buffet dinner. After dinner, the MC and Dean Liebowitz presented awards and trophies to all the winners of the events during Engineers' Week: volleyball tournament, bridge building contest, Rube Goldberg contest, egg-drop contest, and the Tetris competition. In addition, special recognition awards were presented to the Executive Board of the Engineers' Council for their dedicated service to the SEAS student body. They were Qusai Al-Shatti, Leila Balali, and Marwan Omeish. Nelson Kee and Glen Popick, editors of the *Mecheleciv* also recieved recognition for their hard work. Also for the first time, the Dean presented a Certificate of Commendation to Javid Sonde, President of the Engineers' Council for his relentless efforts and service. After the awards, the Dean of Students, Gail Short Hanson added a few words of support and encouragement from the George Washington University and then John David Morris took the floor. He presented a token of appreciation to Javid Sonde for his hard work with the GW student association to bridge the gap between the SEAS and the other schools at GWU. Finally, Dean Liebowitz spoke of his future plans for SEAS and his everlasting commitment to excellence.

When all the awards and speakers were finished, Mr. and Mrs. Liebowitz led the students to the dance floor and the band, Smoothe Criminal got everyone dancing. The band warmed them up with top 40 hit songs and then the DJ pumped up the floor with his mix of club music. Join us next year at the 61st Annual Engineers' Ball. ■

'The band at the ball was out of this world. We danced the night away!'



Dean Liebowitz with Javid Sonde, Engineers' Council President.

WEEK 1990

Congratulations!!!

By Cecile Silvestre

On March 23 the School of Engineering held a luncheon in the Marvin Center's University Club honoring engineering students for their academic achievement. The list of the honored students also appeared in a recent issue of the Hatchet. The banquet was well attended by the students and their parents along with the professors and the administration. During the banquet, certificates were awarded to those earning a Dean's Honor, for those with a GPA of 3.5 or higher, or a Dean's Commendation, for those with 3.0-3.49 GPA, for the spring and fall of 1990.

In addition other departmental and engineering organization awards were presented. The Outstanding Sophomore was awarded by the Tau Beta Pi to Jon Schmidt, who had the highest GPA with sophomore status in spring 1989. Laura Gruber won the Alfred Martin Freudenthal prize awarded annually to a senior with the highest scholastic standing. The Abdelsattah Abdella prize given by Eta Kappa Nu went to Jason Fay for his outstanding services to the IEEE, Eta Kappa Nu, and to the EE/CS department. Angel Lozada was awarded the George Ellowitz prize. The award, in honor of George Ellowitz, is given to a graduating senior who shows a broad interest in the Humanities and Social sciences as shown by extra curricular activities and or courses taken. A university-wide honor's convocation followed in Lisner auditorium for students who were in the top 2% of their class with Professor Marcus Cunlisse as the guest speaker.

We of the *Mecheleciv* would like to express our deepest thanks to the outgoing Engineers' Council, especially Javid. They served both SEAS and the GW community as a whole, and deserve our appreciation.
Best of luck to:

President - Javid Sonde
Vice President - Qusay Al-Shatti
Secretary - Rama A. Chakaki
Assistant Secretary - Leila Balali
Treasurer - Marwan Omeish
Davis-Hodgkins House Manager - Ismail Aboustan
Engineers' Week Chairman - Autumn Pakravan
Graduate Rep. - Khursheed Anwar
Graduate Rep. - Mansoor A. K. Niazi
Senior Rep. - Mario Pachajoa
Junior Rep. - Glen Popick
Sophomore Rep. - Cecile Silvestre
Freshman Rep. - Kara Morely
IEEE Rep. - Richard Biby
ASCE Rep. - Joseph O'Neil
ASME Rep. - Dave Herbert
BES Rep. - Damon Yancy
TBP Rep. - Sanjeev Gulati
HKN Rep. - Jason Fay
NSPE Rep. - Greg Friend
Graduate Senator - Chris Fuedo
Theta Tau Rep. - Jeffrey Dion
MECHELECIV Co-Editors - Nelson Kee, Glen Popick
KESA Rep. - Sangbeom Kim
Faculty Advisor - Derrill C. Rohlfs

Welcome to the 1990-1991 Engineers' Council

President - Bobby Makheja
Vice President - Marwan Omeish
Secretary - Chong Bum Lim
Assistant Secretary - Steven Fischer
Treasurer - James Nix
Davis-Hodgkins House Manager - Rosihan Jaafar
Senior Representative - Glen Popick
Sophomore Representative - Dong Min Park

We know that you will uphold the tradition of excellence that was established by this year's council.

Congratulations to the Korean Engineering Student Association on their recent acceptance into the Engineers' Council as a voting member. We all look forward to working with you in the future.

Why go to Disney World when you have *Mecheleciv!!!* You'll have more fun and excitement right here at home!

Mecheleciv would like to end this issue with a questionnaire. We hope to get a little input and to encourage involvement from our readers. We are constantly trying to improve and serve our reader's needs and we need your words of wisdom. So we would appreciate it if you would answer these questions and return this sheet to the following address :

Mecheleciv
David-Hodgkins House
2142 G Street, N.W.
Washington, D.C. 20037
Telephone No. (202) 994-3998

1)For those interested in joining the *Mecheleciv* family:

Your name, address & telephone no.:

2)What do you think of our magazine? :

3)Do you have any constructive ideas that we could use?

4)Can you help with: writing/editing/photography/advertising/promotion (circle one).

Thanks for answering our questions. Please feel free to write to us anytime and if you wish to join up talk to any one on our staff, call, or drop by our office at the David-Hodgkins House. We will be waiting!

Don't worry, be *MECHELECIV*

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FOR YOUR INFORMATION

MECHELECIV encourages all students, alumni, faculty, and staff of the School, and our other readers to contribute to or join the magazine and avail of this unique opportunity for organizational, journalistic and artistic experience, as well as receive exposure and recognition.
For more information, please call (202) 994-3998 or write to *MECHELECIV*.

SUBSCRIPTIONS AND CONTRIBUTIONS

MECHELECIV is distributed to all Engineering School students as a service provided by the Engineers' Council. A portion of the fee paid by each student is meant to cover a one-year subscription to the magazine. Engineer Alumni can receive *MECHELECIV* either by subscribing to the magazine, using the card below, or by making a contribution to the magazine. Alumni are urged to contribute to preserve this exceptional service to the Engineering School community.

Payments may be made out by check or money order to "*MECHELECIV*, GWU" and addressed to:

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